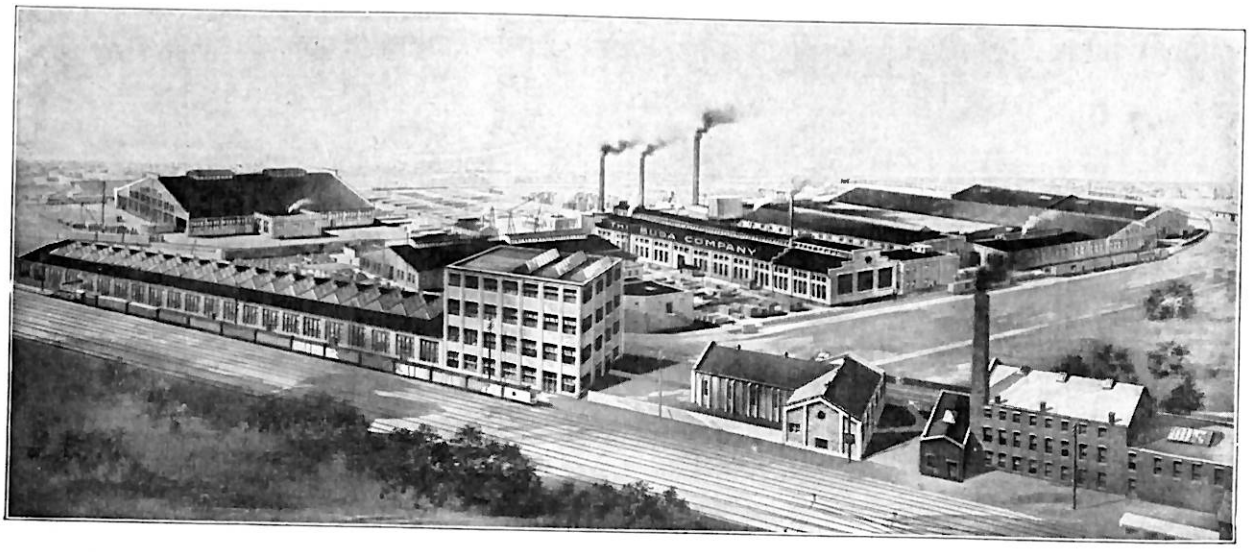
SUPERIOR ENGINE SERVICE

Superior Engine Service



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HARVEY [CHICAGO SUBURB] ILLINOIS

INDEX

Years of Service
1

EVERY owner of a Buda engine can rightfully expect many years of satisfactory service. Thousands of Buda engines have demonstrated that the manufacturers have done their part well toward building an engine which would insure constant operation and freedom from difficulties.

The Owner's Part
2

But no matter how well an engine is made, it requires a reasonable amount of care and attention. The owner must contribute his necessary part. There is no better way to understand what an engine requires than to carefully study the following directions and closely adhere to instructions which have been worked out by men who understand the necessities.

A few minutes of concentrated abuse will perceptibly shorten the life of the best engine.

This book is not intended to be a complete treatise on the care and operation of engines, but it is designed to help the user avoid common mistakes which are very frequently allowed to occur through ignorance.

These suggestions are for the benefit of owners and drivers of cars, trucks and tractors containing Buda 4-cylinder engines.

Some of the suggestions which we make may seem inconsequential, but if you could see the care that is used on even the smallest items in our factory, you would realize how much you can prolong the life and efficiency of your engine if you will pay some attention to each particular feature which we mention.

This book is not expected to make it possible for an amateur to do the work of an expert, but it should point the way to the avoidance of common troubles and in that way minimize the necessity for repairs.

Many a trouble can be traced to some simple thing, like a carelessly made connection, dirt in the gasoline, a broken wire, a broken spark plug, etc., and drivers who understand the operation of an engine never condemn it for simple things which are due to carelessness more than anything else.

It is possible that this book does not contain all the information you desire. We will gladly supply additional information regarding the care and operation of your Buda engine if you will write direct to The Buda Company, Harvey, Illinois.

Buda Tests 3

It has always been our idea to build a quality engine but we have no desire to build the largest number of engines. Dependability is the most important factor in the success of Buda engines.

After the many tests have been made on each individual part and the Buda engine is all assembled, it is given a running dynamometer test.

The engine is run under its own power and made to drive an electric dynamo which registers the actual horsepower developed. After this test, each engine is dismantled, the pistons are removed and the bearings thoroughly examined. Any necessary adjustments are made and the motor reassembled.

Then comes the long work-out under its own power for a length of time sufficient to make it run with perfect freedom and remove most of the stiffness which is usually found in all new engines.

When you first receive your motor, bear in mind that it must go through a seasoning or settling process. The parts that have been subjected to machine work and other strains have to gradually adapt themselves to their operating conditions.

A new engine should be carefully watched for loose parts, for no matter how well an engine is made at the factory there is a certain amount of elasticity in all metal which gradually works out as the engine is broken in and therefore parts are not always as tight after the engine has been running a short time as they were when the engine left the factory.

Operation of 4-Cycle Engines 4

Within each cylinder of the motor is a piston which has an upward and downward movement.

This movement is controlled by a crank shaft to which each of the four pistons is attached by means of a connecting rod and piston pin.

The full movement of a piston in either direction is called a stroke. There are two strokes of the piston to each full revolution of the crank shaft.

A four-cycle motor is one in which one explosion occurs in each cylinder to every two revolutions of the crank shaft or to each four strokes of the piston.

These four strokes are named in the order in which they always appear, namely: (a) Suction Stroke, (b) Compression Stroke, (c) Firing or Power Stroke, and (d) Exhaust Stroke.

There are two valves to each cylinder, the intake valve and the exhaust valve, for the purpose of opening and closing passages between the intake and exhaust manifolds and the cylinder.

The valves are made to open by the action of cams upon a cam shaft located within the crank case, and driven at half crank shaft speed. They are closed by springs.

If the crank shaft of the motor is revolved until the first explosion occurs, the following action takes place within the cylinder.

Upon the Suction Stroke (a) of the piston the intake valve is mechanically opened, and as the piston moves downward gas is drawn from the carburetor (by the partial vacuum created) into the increasing space between the top of the piston and the head of the cylinder. (The exhaust valve is closed at this time.)

At the end of this stroke the piston starts upward (b) (Compression Stroke), both valves are made to close and the gas is compressed into a small space, making it highly explosive.

When the end of the stroke is reached, and just as the piston starts downward again, the compressed charge is ignited by means of an electric spark which takes place between the points of a spark plug screwed into the intake valve chamber cap.

The ignition of the gas causes an expansion or explosion which drives the piston rapidy downward (c) (Firing or Power Stroke), at the same time imparting movement to the other three pistons which are attached to the same crank shaft.

Both valves remain closed during this stroke.

In the next stroke, which is upward (d) (Exhaust Stroke), the exhaust valve is opened to allow the burnt gas to be forced out by the piston through exhaust manifold and muffler into the open air. The intake valve remains closed during this stroke.

These strokes follow each other in the manner described as long as the engine is in operation and exactly the same series of actions occur in all four cylinders, although no like strokes are taking place at the same time in any of the cylinders; that is, when one of the four pistons is on its Suction Stroke, another is on its Compression Stroke, another is on its Firing Stroke and the other is on its Exhaust Stroke.

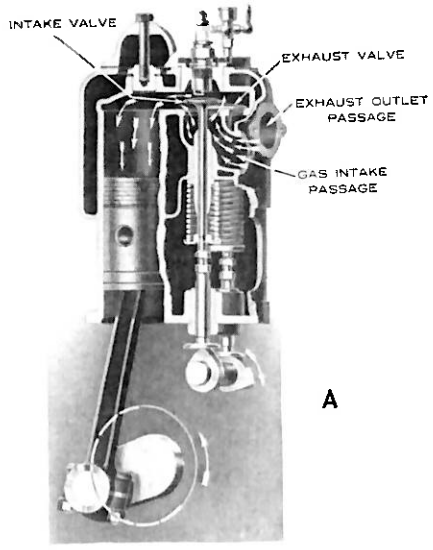
In this way the explosions are so divided that there is one power impulse to each half revolution of the crank shaft.

The explosions always occur within the cylinders in this order: No. 1, No. 3, No. 4, No. 2.

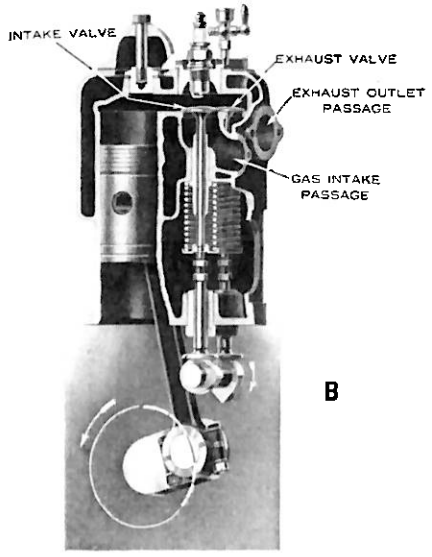
This is termed the firing order of the motor.

No. 1 cylinder is the one nearest the radiator.

The operation of four-cycle engines built by the BUDA COMPANY may be better understood by the accompanying illustrations:



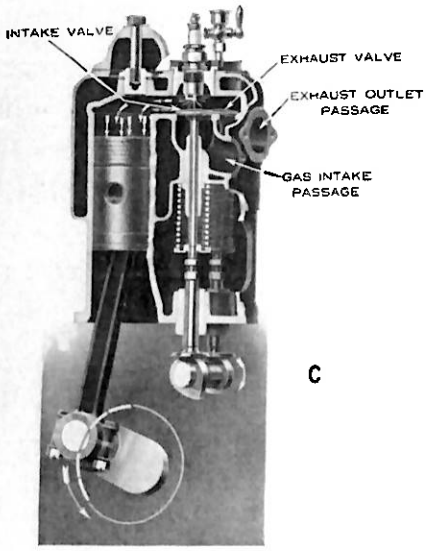
A



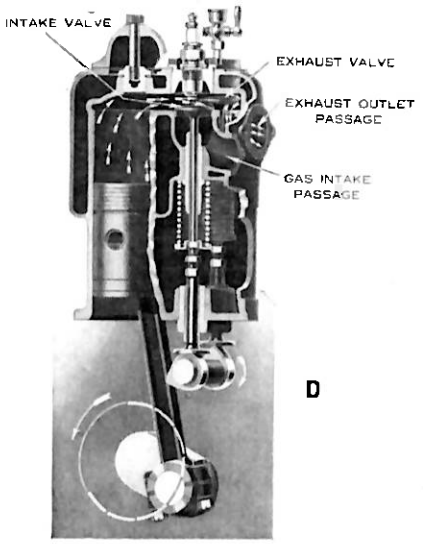
B

(a) Suction stroke. Piston is moving from top to bottom of the cylinder. Intake valve is open, allowing mixture of gas and air to enter cylinder. Exhaust valve closed.

(b) Compression stroke. Piston moves from bottom to top of cylinder, compressing the charge to about ¼ its original volume. Both valves closed.



C



D

(c) Power stroke. Compressed charge is fired by a spark across points of spark plug, driving piston down. Piston moves from top to bottom of cylinder; both valves closed.

(d) Exhaust stroke. Piston moves from bottom to top. Exhaust valve open, allowing burned gas to escape. Intake valve closed.

Preparing the Engine for Operation

Filling the Radiator 5

See that all drain cocks in the water system are closed and fill the radiator with clean water. Make sure that the radiator is always kept supplied with plenty of water, to prevent the engine overheating.

Filling Gasoline Tank 6

Give particular attention to our instructions regarding gasoline.

Use nothing but the best grade of gasoline. It gives the most power and does not carbonize the cylinders as rapidly as low grade gasoline, which also spoils the lubricating qualities of oil.

Always strain the gasoline to remove any water or other impurities that may be present. (Many drivers use chamois skin.) All strainers should be cleaned out at frequent intervals.

Filling Oil Reservoir 7

We give specific instructions regarding the grade of oil to use and the methods of lubrication. You will save yourself a great deal of trouble and expense if you give close attention to the lubrication question in your motor.

The Right Oil
8

A high grade engine requires *good oil* and oil of the *right body.*

The oil system should be *kept clean* by draining the crank-case regularly and often. (See special instructions under paragraphs No. 30.) *GET THE ADVICE* of your oil supplier, or better still, ask the maker of your vehicle for a recommendation.

Cleaning New Engine
9

You will find all new bright metal fittings and other parts subject to rust covered with a heavy oil. Some gasoline on a stiff brush or rag will remove this oil. If this is neglected, dust and dirt will collect and leave your engine dirty. Never use waste to clean your engine as the lint sticks to the surface and might get into the carburetor.

See that your engine is clean inside and out all the time. The air which goes into the carburetor draws with it dust and dirt which will not only stop up the carburetor, but if this dirt passes on into the engine it causes rapid wear to pistons and cylinders or it may work down into the bearings.

In very dusty localities, particularly in the case of tractors working in the fields, it is desirable to provide the carburetor with an air cleaner to prevent the entrance of dust. There are several such devices on the market.

If your motor should act irregularly do not have it immediately torn down and rebuilt; this applies especially to a new engine. First know what you are about before you go ahead.

Nothing injures a motor more than to tinker with it, unless it is the unconscious neglect of some detail which results in premature wear or injury to the engine.

Alignment of Engine
10

The engine must always be properly aligned with the other units in the chassis, and rest squarely on the brackets intended to carry it. No unnecessary strain should be put upon any part of the crank case when the engine is bolted down. All bolts should be kept tight, as any looseness in these bolts permits a hammering and pounding of the engine upon its brackets, which in time crystallizes the metal and breakage results.

Suspension
11

Buda engines are of the three-point suspension type and the trunnion bracket must fit properly (so that no binding occurs at this point), leaving the engine free to turn in its front support. Any bind here destroys the object for which three-point suspension was intended, namely, to allow for a reasonable amount of flexibility in the frame without binding the working parts of the engine.

Other Transmitting Elements
12

See that there is no undue friction in any of these units. The proper instructions for operating the clutch, transmission, etc., should be obtained from the manufacturer of these parts or from the maker of your car, truck or tractor.

Radiator Mounting 13

A Radiator is mounted as closely to the fan as is possible without creating the excessive noise that would develop when a fan is too close. Too great a distance from the radiator causes the fan to lose a great deal of its efficiency. Sufficient hose should always be allowed in connecting the top of the radiator and water jacket cover to avoid any strain on these connections. The engine weaves in its front support as the car passes over rough o. uneven roads and this would destroy the hose. Avoid any sharp bends or kinks which would retard free passage of water.

Attaching Governor 14

When attaching a governor, see that it works in perfect harmony with reciprocating parts. It should not allow the engine to run at a speed beyond that recommended for your particular type of engine. (See paragraph 17 for safe speeds.). A great deal of harm can be done to the engine by overspeeding it, and this should be avoided at all times.

Racing a Cold Engine 15

A cold motor should be warmed up slowly, as it is dangerous and detrimental to race or accelerate a cold motor. This does more harm than constant service under full load at correct motor speed.

Never race a cold engine. Where this instruction is disregarded and the engine is speeded up beyond the speeds which we indicate as the safe running speeds, you are inviting trouble, repairs and expense.

Governing 16

When you first start to run the engine do not go above a medium speed until the bearings, pistons and cylinders are running perfectly free.

This is a most important factor—controlling or governing the speed of your engine.

All heavy duty engines (particularly for truck and tractor service) should have a governor or a speed controlling device which will be thoroughly efficient and work properly under all operating conditions. This speed controlling device should be adjusted so as not to allow the engine to run at speeds beyond which we indicate below. You will understand the difference between the terms SAFE CONSTANT SPEED AND MAXIMUM SAFE SPEED FOR SHORT PERIODS and will appreciate that there is a vast difference between them:

Safe Speeds 17

Model	Safe Constant Speed	Maximum Safe Speed for Short Periods
"RU" "QU"-"OU"-"TU"	1400 R.P.M. per min.	2000 R.P.M. per min.
"HU"-"IU"	1100 R.P.M. per min.	1800 R.P.M. per min.
"XU"-"YU"	1000 R.P.M. per min.	1200 R.P.M. per min.

Buda Attention Chart—For Ordinary Driving

How Often	Parts to Inspect	Refer to these Paragraphs	Attention Required
Daily 50-100 miles.	Oil pan	8, 9, 29-34	Keep indicator a little above half way mark
	Gasoline tank	6	Have plenty of gasoline
	Cooling system	5, 49-54	Keep radiator full of clean water
	Water pump		Turn grease cup
	Radiator fan	53	Turn grease cup
Weekly 200-500 miles.	Oil system	29-34	Drain oiling system. Fill oil pan through breather system with fresh oil
Monthly 600-1000 miles	Spark plugs	36	Test plugs for bright sparks and see that they are clean
	Batteries or magneto	39-42	
	Bolts, nuts, etc.		Tighten any that have worked loose
	Valves	65	If pitted, see that they are ground
	Cylinders	47	If coated, see that carbon is removed
	Pistons	46	Test compression
	Radiator	50	Clean thoroughly by flushing. See that all gaskets are tight
	Electrical connections	35-42	Clean and tighten all connections
Annually	Oil pump	24	Remove pump and clean entire oiling system
	Entire engine	69	General inspection and cleaning
	Water jacket	50	
	Tappets	46 and 64	
	Bearings	57	

Lubrication

Proper Lubrication 18

This is one of the most important features of any engine. Be sure to study the lubricating system carefully so you will understand thoroughly its care and operation.

If lubrication is once neglected it can cause any amount of damage and expense.

Grades of Oil 19

We do not specify the particular oil, but on request will furnish the recommendations of our engineering department. The oil required will vary with the climatic and service conditions under which the engine is operated. This information can also be secured from local oil men and by trials with different grades of lubricating oil.

Automatic Lubricating System 20

The lubricating system in Buda engines automatically lubricates all internal bearings in the engine. Only the water pump and radiator fan need be lubricated separately. These are fitted with grease cups which should be inspected daily to see that each cup is filled with the best grease obtainable. The best is always the cheapest in the long run.

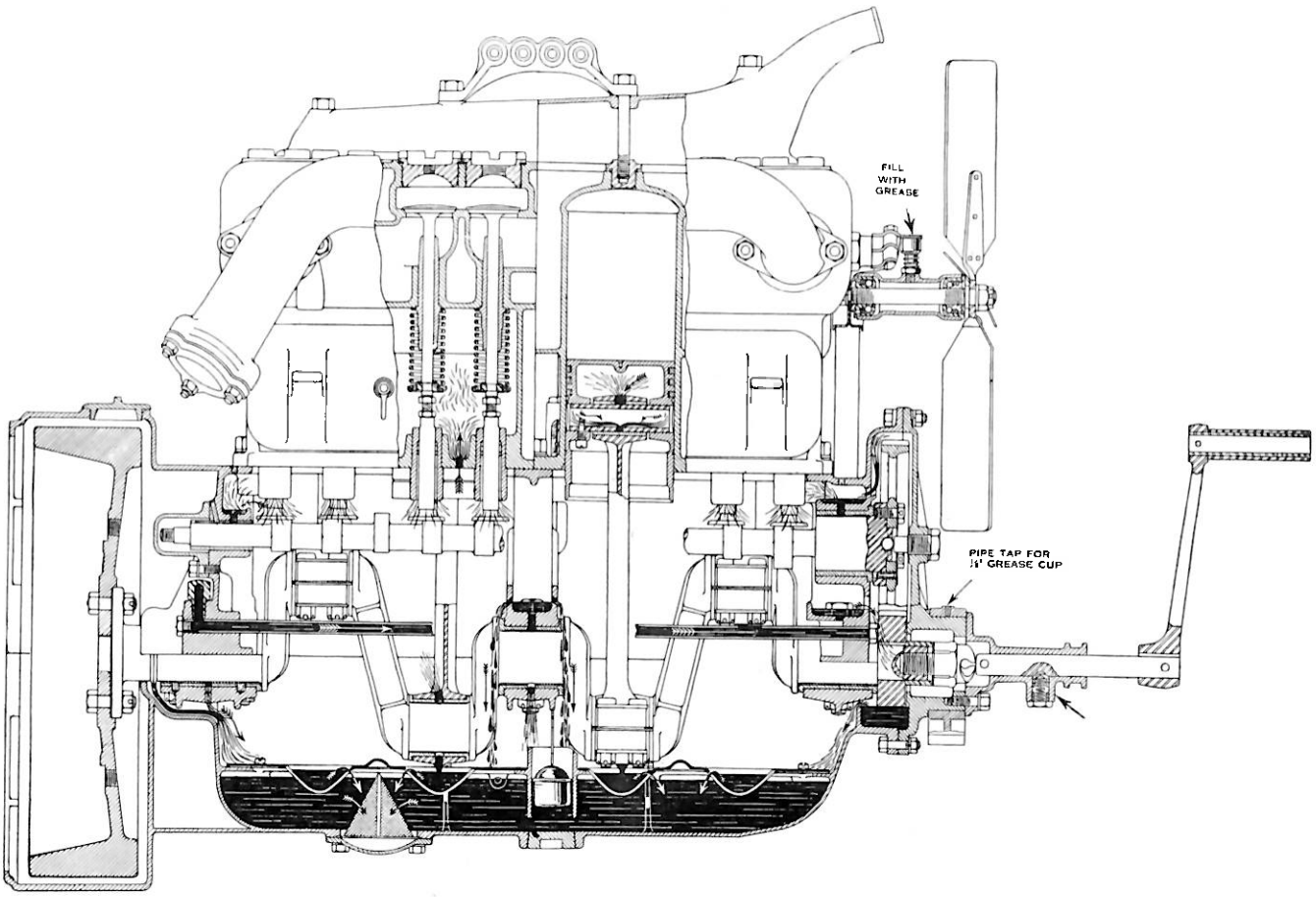


ILLUSTRATION NUMBER 5

Diagram showing the lubricating system in Buda models QU, OU and TU engines. This well illustrates the oil flow and shows the direction of travel, as well as the location of the oil level indicator and the drain plug for cleaning out the pan and the oil screen.

Lubricating System for QU-OU-TU Models

21

This is known as a combination positive feed and constant level splash system operated by a *plunger* pump driven by an eccentric on the cam shaft, and is easily removable for inspection and cleaning.

Operation

22

The bottom of the oil pan acts as an oil reservoir. The suction side of the oil pump is connected to the lower part of reservoir, which insures a supply of oil for the pump as long as there is any oil in the reservoir.

The oil pump discharges into a steel distributing tube located horizontally the full length of the crank case.

This steel distributing tube has openings which discharge oil into the connecting rod dipper troughs and into the oil pocket above each main crank shaft bearing.

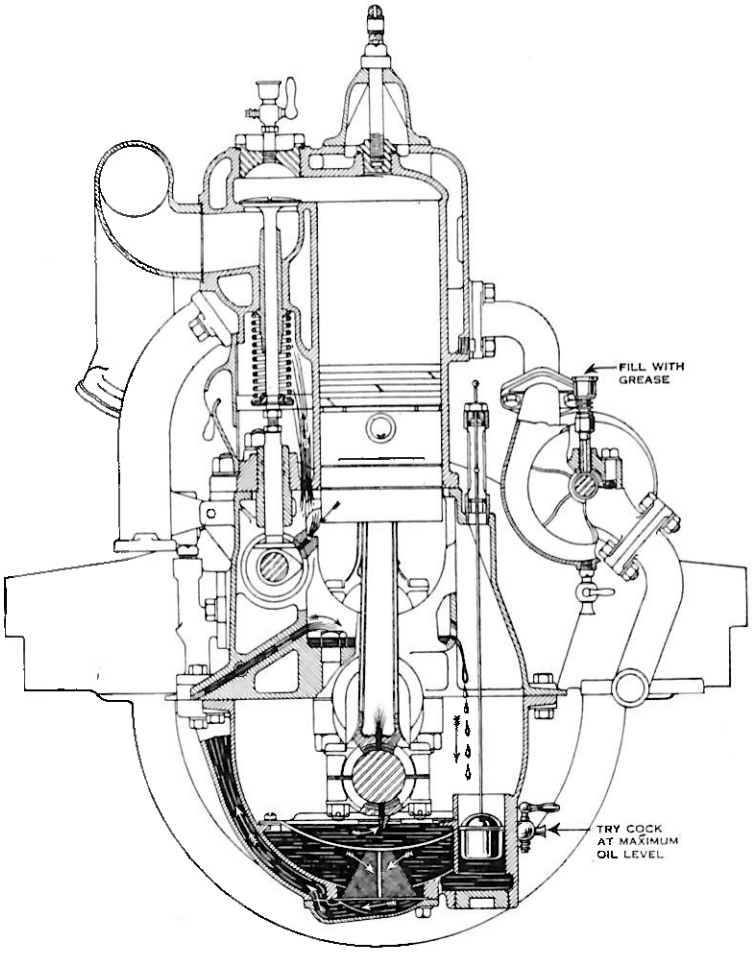


ILLUSTRATION NUMBER 6

Looking from the timing gear end. This illustrates the operation of the oil pump in Buda models QU, OU and TU, also note the arrangement for splash and overflow of the oil, as well as the relation of the oil level indicator and screen. This view should be studied in connection with illustration No. 5.

The Oil Flow
23

The oil overflows from these pockets into the connecting rod dipper pockets, the surplus oil from front crank shaft bearing overflows into the timing gear case compartment. This is arranged to maintain the oil level at the proper height for lubricating the timing gears. From this point the surplus oil overflows into the front connecting rod dipper pockets. These pockets have an opening milled to the proper height to maintain a constant oil level.

All surplus oil from these connecting rod dipper pockets returns to the oil reservoir. The lower ends of the connecting rods are provided with an oil dipper of the proper shape and length to lubricate the crank pin and cause enough splash to lubricate cam shaft bearings, cam, tappets, pistons, piston pins and valve stems.

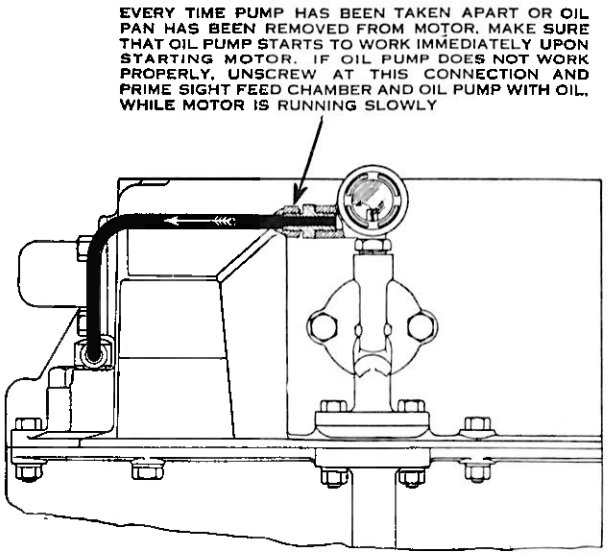


ILLUSTRATION NO. 7
On the former models we furnished a sight oil feed, now a pipe plug which is easily removable is being used.

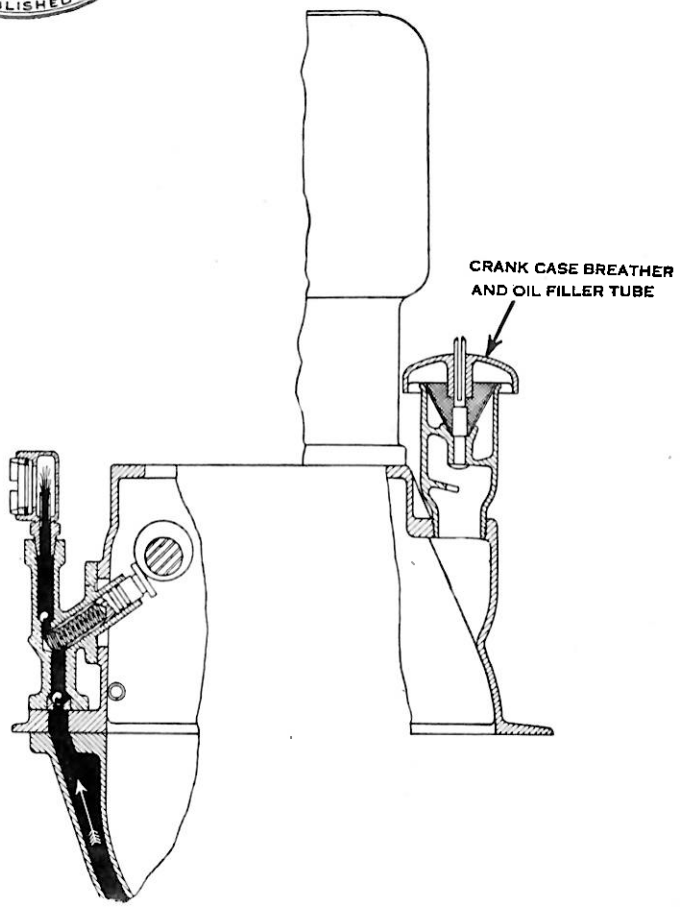


ILLUSTRATION NO. 8
In this diagram you will see the plunger oil pump, the cam which operates it and the steel ball check valves which control the flow of oil.

ILLUSTRATION No. 9
This illustration and illustration No. 8 are shown in their respective relations. Through the breather tube fresh oil is put into the oil reservoir.

The main crank oil pockets always insure an abundance of oil and are provided with an overflow so located that the oil will not flow on crank shaft cheeks. This avoids throwing excess oil into the cylinder and causing motor to smoke.

When Oil Is Needed

24

The engine should be drained and filled with fresh oil every 500 to 1,500 miles, and at least once a year the oil pan should be removed and thoroughly cleaned.

It is essential that the oil in oil pan register half way between the two (2) lines shown on oil level indicator. Therefore you should replenish the supply as soon as the oil level falls below point recommended. The oil indicator should always show that you have oil enough to keep the flow at above the half full mark. The grease cups in water pump and fan should always be kept full.

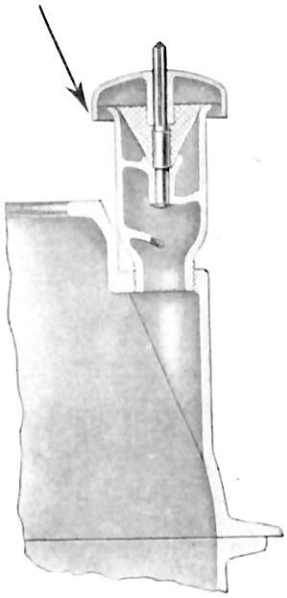


ILLUSTRATION No. 10
This is the type of breather formerly supplied.

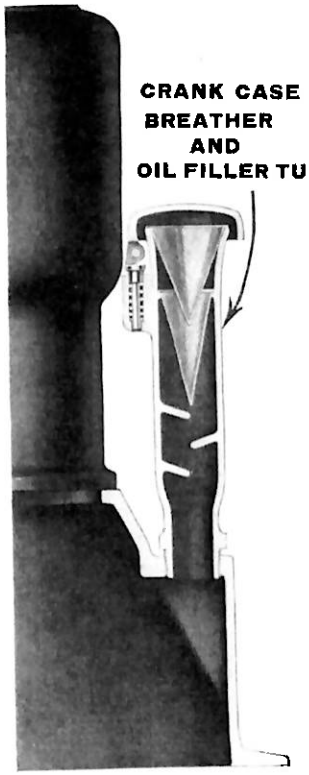


ILLUSTRATION No. 11
This is the new long breather tube which is being supplied on Buda engines.

After each 500-1500 miles of running, all oil should be drained from crank case and out of pan. These should be thoroughly cleaned with kerosene before replenishing with fresh oil.

This is also your opportunity to clean out the oil screen. This screen will not become clogged with sediment very quickly if you strain the oil through cloth whenever you put oil in the engine.

What to Lubricate 25

There are only four places to lubricate on a Buda engine. The only place to be filled with oil is the oil pan. The water pump and fan grease cups require a good grade of grease.

Lubricants—How Applied 26

The lubricant is put into the oil pan through the breather and filler tube, and in the grease cups by removing their caps.

Lubricants to Use 27

Engines having the pressure feed or full forced feed type (Buda types HU and YU) of lubricating system should be supplied with reliable oil of correct viscosity and flash test.

For engines having the combination splash and plunger system (Buda types QU, OU and TU) a lighter body oil is recommended.

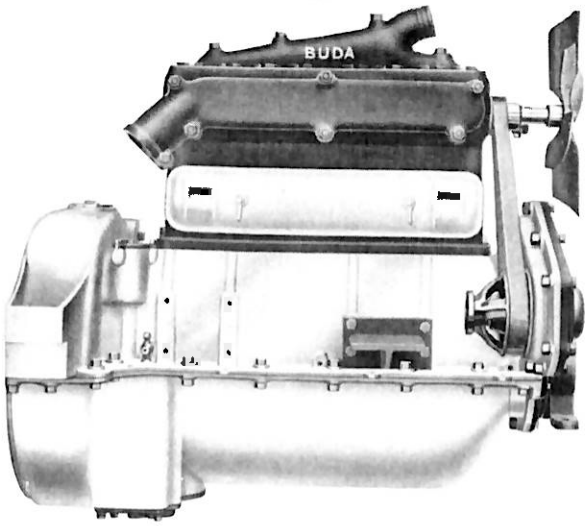


ILLUSTRATION No. 12
The exhaust side of Buda model RU engines showing the provisions made for mounting the water pump and magneto. This also shows the simple construction of Buda engines which makes it possible to get at the working parts readily.

All grease cups should be filled with *clean* cup grease as often as required.

The Breather
28

All Buda engines are provided with a combination breather and oil filler tube, which acts as a ventilator for crank case to prevent crank case pressure and temperature.

Amount of Oil
29

Never fill engine too full of oil, as it will cause carbon to form and foul the spark plugs. A careful driver will soon learn how much oil an engine uses for each 100 mile trip.

Draining Oil Pan
30

The oil pan is provided with a drain plug for draining off the oil when the oiling system needs cleaning. It is best to drain off all oil after the engine has been thoroughly warmed up. Fill the engine through the breather with kerosene till the oil level indicator registers full to the top. Then run the engine idle from 2 to 3 minutes at about half normal speed (500 to 700 R.P. M.) so all parts will be thoroughly washed. Drain off kerosene and repeat the operation. After which the engine can be filled with good motor oil and run for another 500 to 1,000 miles before cleaning.

If the engine is operated in a very dusty locality it may be advisable to clean out the oiling system every 200 or 300 miles.

Engines for farm tractor work should be cleaned out at least twice a week (some tractor users do this twice a day), and the carburetor intake opening should be fitted with a dust separator and all openings should be protected from dust entering into cylinder.

The above instructions, if followed, will increase the life of your engine considerably.

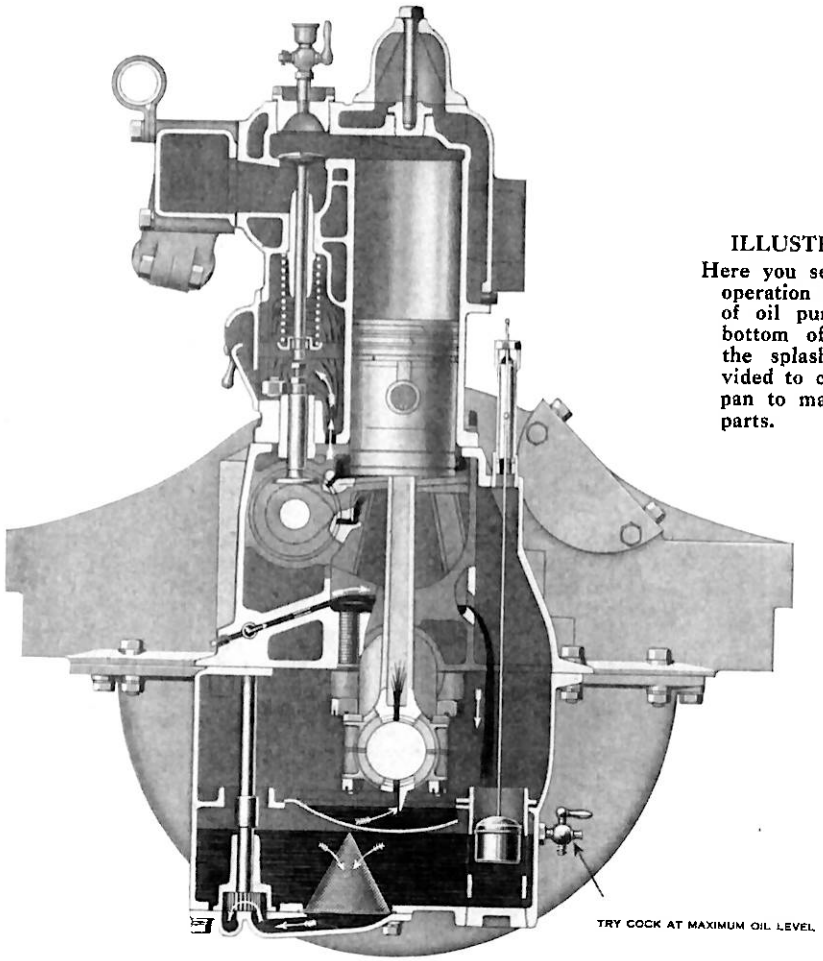


ILLUSTRATION No. 13
Here you see very plainly the operation of the geared type of oil pump. Note on the bottom of the piston crank the splasher which is provided to convey oil from the pan to many of the working parts.

Lubricating System for Model "RU" 31

This is known as a combination positive feed and constant level splash system, operated by a geared oil pump.

The operation of this system is similar to that used in Buda QU, OU and TU engines, except that a *geared* type oil pump is used. This is located in the base of the oil reservoir, entirely submerged in oil, and is driven by a vertical shaft in connection with the cam shaft. The pump is easily detached for cleaning or inspection from the bottom of the oil pan by removing 6 cap screws.

Lubricating Systems for Models "HU"-"YU" 32

This is the pressure feed of full forced feed type, designed for heavy duty truck or tractor service.

The pump, which is of the geared type, is located in the base of the oil reservoir, entirely submerged in oil. It is driven by a vertical shaft in connection with the cam shaft and is easily detached from the outside for cleaning or inspection, from the bottom of the oil pan, by removing 6 cap screws.

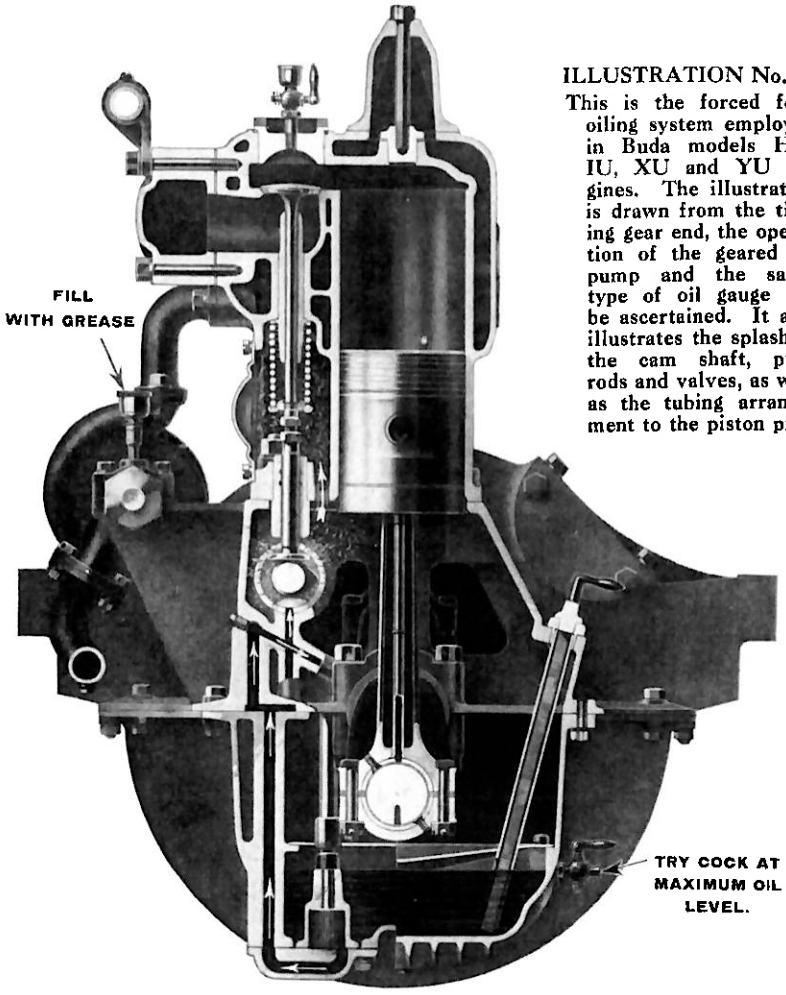


ILLUSTRATION No. 14
This is the forced feed oiling system employed in Buda models HU, IU, XU and YU engines. The illustration is drawn from the timing gear end, the operation of the geared oil pump and the saber type of oil gauge can be ascertained. It also illustrates the splash to the cam shaft, push rods and valves, as well as the tubing arrangement to the piston pins.

The oil is drawn from the lower oil reservoir through a fine mesh screen and discharged by a steel distributing tube located horizontally the full length of the crank case into connecting passages which carry the oil directly to each cam shaft bearing and main crank shaft bearings.

From the crank shaft main bearings the oil is forced through the drilled crank shaft to each connecting rod bearing; from the connecting rod bearings the oil is forced through a small tube up the connecting rods to the piston pins. Cylinder walls and pistons are lubricated by oil thrown from the lower end of the connecting rods.

The oil, thrown from the lower ends of the rods or "kicked up" by the splash system, is caught by the piston and carried up into the cylinder, lubricating these parts.

Oil Pressure

A pressure of thirty pounds is maintained at 1000 R.P.M. of the crank shaft and is controlled by a regulating valve located in the line. This valve

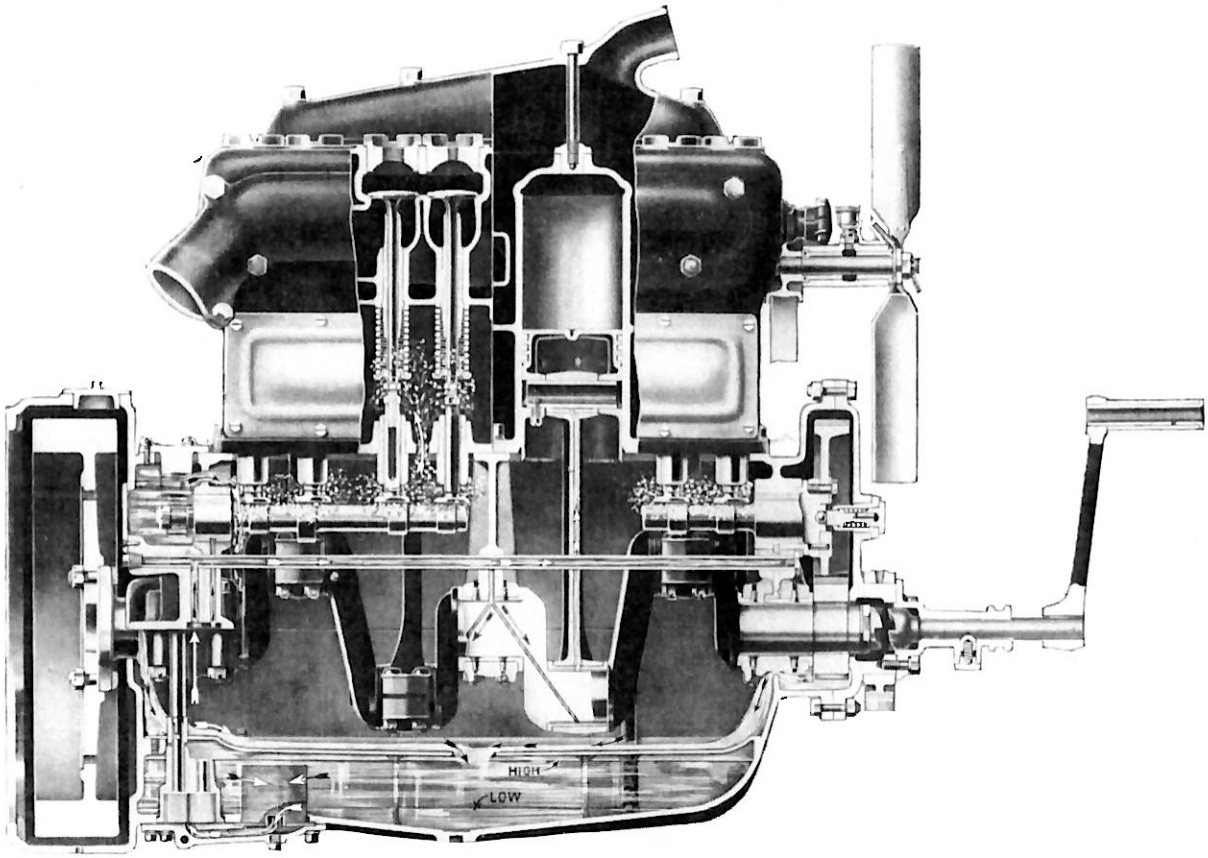


ILLUSTRATION No. 15

Here is the complete detail of the operation of the full forced feed oil system, showing the drilled crank shaft and the direction of travel of oil through it.

is of the ball and spring type and readily adjusted from the outside of the engine.

Provision is also made to connect a gauge in this system which can be mounted on the dash, enabling the operator at all times to know the condition of his oiling system. Any obstruction or leak in the line can readily be detected by such a gauge.

Timing Gear Lubrication
34

The Timing gears are also lubricated from the pressure system, a constant level being maintained in the gear case, the overflow returning to the lower reservoir.

Valve stems and push rods, being enclosed, are lubricated by oil vapor from the crank case through holes drilled in the base of the cylinder.

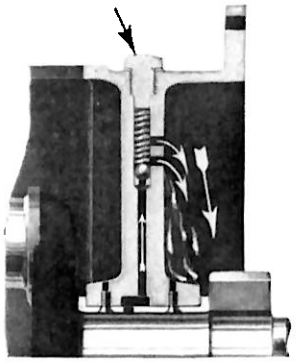


ILLUSTRATION No. 16

Oil pressure is regulated by this check valve. Regulation is simply made by the addition or removal of washers to increase or decrease the pressure of the spring which holds the ball on its seat.

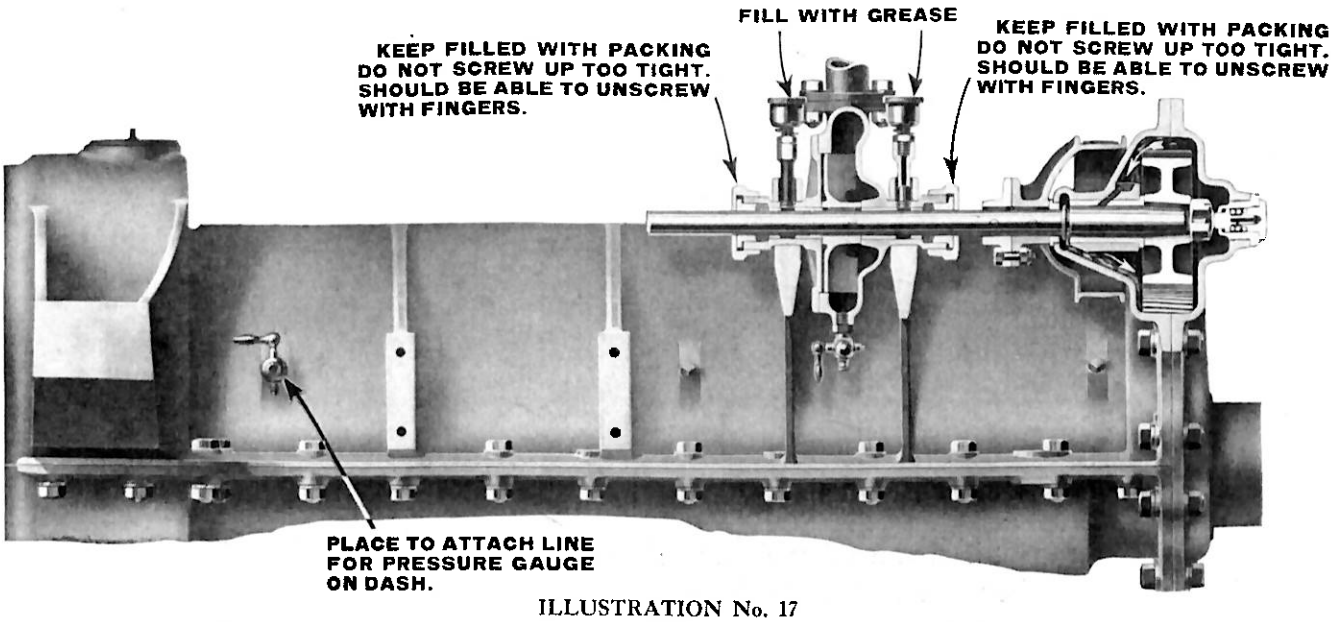


ILLUSTRATION No. 17

Facilities are shown here for attaching pressure gauges on the dash of the car or truck. This also illustrates the water pump and the lubrication arrangements.

Ignition

Wiring
35

When connecting up the ignition, see that same is wired and timed as per instructions furnished by manufacturers of magneto and timing devices and that there are no broken wires or loose joints.

The ignition wires should always have properly fitted copper terminals carefully soldered to the wires, and all screwed connections properly tightened. There are so many different magneto and battery ignition systems, we do not show any particular one.

Spark Plug Attention
36

Spark plugs can be the source of much trouble and will cause uneven firing if they are fouled with too much oil, or if there is too great a gap between the contact points, or when the porcelain is cracked.

Spark plugs should be inspected to see they have the proper gap between the points. If the gap is too great the spark will not jump when the motor is under compression; if too close, motor will not throttle nor pick up and plugs are more likely to foul. The gap should be not less than 1/64 of an inch and not more than 1/32 of an inch, 28/1000 would be the ideal distance.

Spark plugs of sufficient length to reach through the port plugs should be used, as when very short spark plugs are used the points are located in a pocket and the motor will be hard to start and may fire irregularly even when warm.

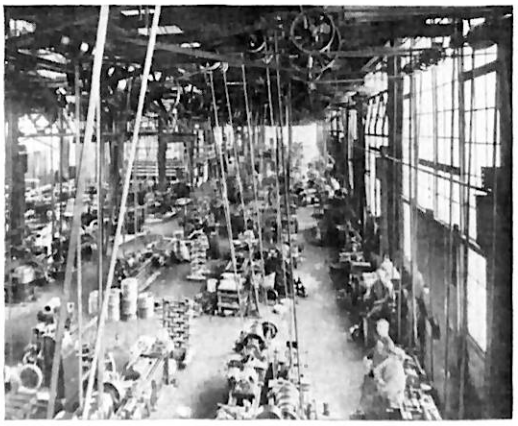


ILLUSTRATION No. 18
One of the crank shaft grinding rooms in the Buda factory.

It is obvious that excessive spark plug length would interfere with the lift of the valve and cause damage.

Back Firing
37

If the carburetor has been properly adjusted and the engine back fires through the gas intake pipe or makes a muffled explosion in one of the cylinders or exhaust pipe, it would indicate incorrect wiring, and that ignition is taking place at the wrong time. In Buda 4-cylinder engines the order of firing is 1, 3, 4, 2, and in 6-cylinder 1, 5, 3, 6, 2, 4. See manufacturers' instructions regarding ignition.

When Engine Misses Fire
38

If the engine misses open the relief cocks in the cylinders one at a time and ascertain which particular cylinder is missing. That cylinder will give no explosion. The spark plug of that cylinder should be examined. If the points are covered with oil or carbon soot they should be thoroughly cleaned; also test out the plug to see that a spark occurs between the points. When no device for testing spark plugs is at hand, this can be done by placing the spark plug (with wire connected) loosely on cylinder so as to complete circuit. Then start the motor and watch points to see if sparking takes place; if not, replace with a new spark plug.

Timing

Setting of Magneto
39

Only when a motor is completely torn down or when tappet adjustments are necessary should there be any occasion to interfere with the valve timing.

Setting, or timing of a distributor head or a magneto so that the spark will occur at the proper time, requires special care. Slight variations in ignition timing cause the motor to perform at a disadvantage, for if set too

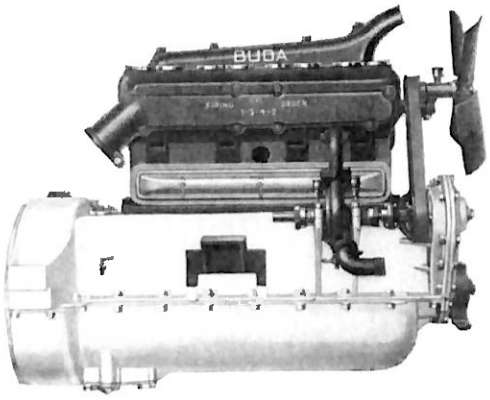


ILLUSTRATION No. 19
This illustration represents Buda models HU, IU, XU and YU engines, and shows the removable oil pump on the bottom of the crank case.

early the motor will "knock," is dangerous to crank and is especially hard on bearings; while if set too late the engine will seem "sluggish," and will not develop its maximum power and has a tendency to overheat.

Four-cylinder engines usually are timed, and give good results, with the ignition so timed as to cause spark to occur on upper dead center (of compression stroke) with timing lever fully retarded.

When a set spark is used it should be timed as early as possible, in order to get full power, satisfactory cooling and no spark knock when engine is delivering its full power. However, our experience has proven that a set spark is not entirely satisfactory on all engines. The size of engine and service in which it is used governs this, and our recommendation is not to use a set spark on motors larger than 4-inch bore.

Regulation of Spark
40

The spark should be advanced as the speed of the motor is increased, and retarded as the speed of the motor is reduced, in order to get the maximum power. A few trials should indicate the correct spark position to give the maximum power at the different motor speeds.

The position of the spark is also somewhat dependent upon the amount of throttle opening, and with a few trials a careful operator will readily observe the proper location.

Magneto Difficulties
41

If the engine is equipped with a magneto which fails to operate correctly, determine whether or not there is a spark between the spark plug points. If a good bright spark is found at this point, then the failure in operation is probably due to incorrect wiring or improper coupling up of the magneto, causing the spark to take place in the wrong cylinders or at the wrong time. If the fault is in the magneto itself it should be referred direct to the maker or to an experienced magneto repair man. Under no circum-

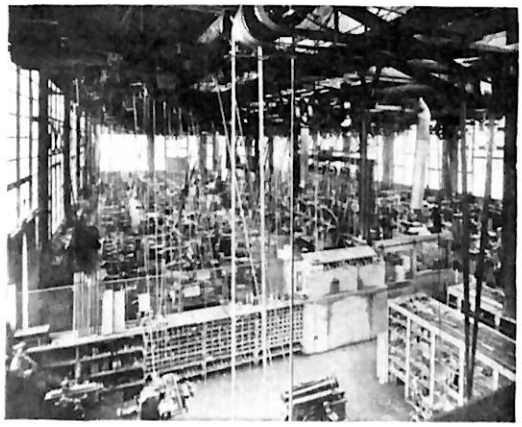


ILLUSTRATION No. 20
Batteries of automatic machines turn out interchangeable parts, but no part in a Buda engine can pass inspection until it meets the closest practicable limits.

stances should the user of a motor attempt to take the magneto apart to correct the fault, as it is a delicate instrument and can be easily damaged by those unfamiliar with its construction.

If, for any reason, the cam gear was not marked when it was removed it will be necessary to retime the valves when reassembling.

Timing the Engine
42

The cams are forged integral with the cam shaft and if one valve is properly timed the balance of the valves must be right provided the clearances are properly adjusted.

The most convenient point to make the setting is at the intake opening point of cylinder No. 1. This will be found marked on the circumference of the flywheel thus "INT. OP. 1 & 4."

Revolve the crank until this mark is in line with the center of the inspection hole in the top of the flywheel housing. Then set .003" clearance on No. 1 intake valve, which would be the second valve in the row. Be sure the valve is properly seated. Revolve the cam shaft in the normal direction until the valve just starts to open. The cam shaft is now properly set in relation to the crank shaft so the gears can be attached. Turn the crank until each valve is seated and then adjust to the proper clearances as given under Paragraph "TAPPET CLEARANCE." Paragraph No. 64.

Carburetion

Gasoline Line Connections
43

All joints in the fuel system must be air tight. All gaskets should be made of suitable packing not doubled or crimped but laid flat and even on the surfaces to be packed. This is very important as any leak in the fuel sys-

tem will cause the engine to run unevenly and prevent the proper carburetor adjustment. Leaks can be detected by applying gasoline on joints while motor is running.

When Your Carburetor Floods
44

When your carburetor floods the engine, note carefully the following suggestions:

See that the gasoline is free from dirt, and read thoroughly the instructions furnished you by the maker of your car and the maker of your carburetor.

A minute particle of dirt in your gasoline will cause a great deal of trouble when it clogs so delicate an instrument as your carburetor.

Adjusting Carburetor
45

Most carburetors are adjusted by the makers and before re-adjusting, run the engine a few minutes to get it warm. It is best to make the adjustments for various speeds one at a time when the motor is running idle.

After the proper adjustment is made for low speeds (under 500 R. P. M.) which can be determined by the smooth running of the motor or by a sharp sound of the exhaust, and carburetor does not pop back, the high speed adjustment can then be made.

If hot air is connected to the carburetor attention should be given to the air passages. They should be equal *or larger than the passages in the carburetor,* in order not to restrict the air supply at high speeds.

It is advisable to adjust the carburetor so that at *high speed* it has no tendency to pop back. Most carburetors are arranged with a high speed gasoline adjustment. This can then be adjusted slightly to supply more gasoline, sufficient only to overcome the tendency of the carburetor to pop back. Then the maximum power can be expected at all speeds. All adjustments should be made a very little at a time, as the carburetor is extremely sensitive.

As the carburetor is a very sensitive instrument, instructions regarding adjustment and operation should be obtained from the carburetor manufacturer in order to obtain the best results.

But in the absence of such instructions the foregoing will be helpful.

Whenever buying a carburetor always specify bore and length of stroke, number of cylinders, and model of your Buda engine. This will enable the manufacturer to supply the proper carburetor. All Buda engines are designed to take 1¼" carburetors except Model YU.

Compression
46

Power depends largely on good compression. Test a warm engine by hand cranking slowly, with the ignition switch off, noting the resistance. If one or all cylinders are rather weak, examine the valves. Either the valve push rods are adjusted too close or the valves are dirty.

Examine piston rings to see that they are not leaking. When rings leak it is necessary to fit new piston rings. Cylinders which have good compression will rock back on compression by letting go of the starting crank before the piston reaches top dead center. (Six-cylinder engines will not rock back on compression.)

Removing Carbon
47

When carbon becomes excessive it results in pre-ignition, overheating, reduces power and a tendency for explosions to continue after the ignition switch has been turned off.

The cylinders can be kept reasonably free of carbon by removing the spark plugs and introducing a tablespoonful of kerosene or denatured alcohol in each cylinder through the compression relief cocks about once a week.

The kerosene should be inserted when the engine is hot, and the motor revolved by hand or by the starter. Best results will be obtained by placing this in the cylinder at night in order that it may have an opportunity to soften the carbon deposit before the engine is used in the morning.

After the engine has been run for some time without cleaning the cylinders, gradually pour about a pint of kerosene through the air valve of the carburetor, with the engine hot and running at high speed, operating at this speed until it stops smoking. Water will also do the same. Do not choke the engine with the kerosene, but put it in as fast as the engine will take it and run.

After this operation, place a tablespoonful of kerosene through the spark plug opening in each cylinder and do not use the engine for ten or twelve hours.

After an excessive amount of carbon has accumulated in the combustion chamber, kerosene *will not remove it.*

An effective way of removing carbon is either scrape it out by removing pistons from cylinders or have it burned out by the means of an oxygen carbon remover outfit, which is part of the equipment in the majority of first-class garages.

Using Carbon Remover
48

We do not recommend it, but carbon remover can be placed in the cylinders in the following manner:

Remove the valve port plugs and crank the engine until two of the pistons are at the very top of their traverse. Place the carbon remover in these two cylinders and allow it to remain for about one hour; then remove by siphoning it out. Do not leave remover in longer as it has a tendency to eat metal. After removing the liquid, dry out the combustion chamber as much as possible with a clean cloth. Repeat the same process for the other cylinders. Ordinarily the same carbon remover can be used over again.

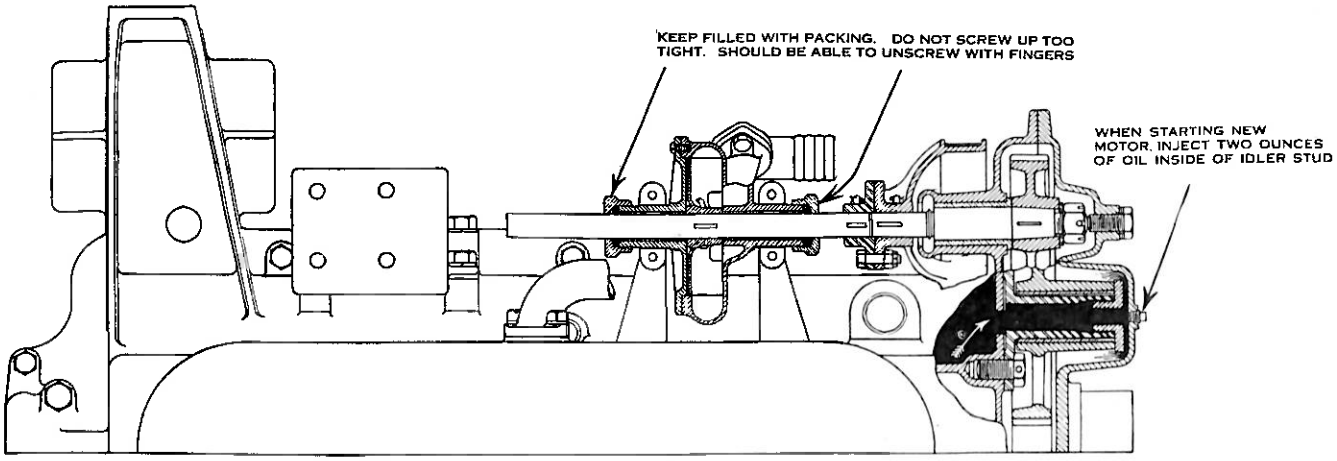


ILLUSTRATION No. 21

This is similar to illustration No. 17, except that it is a top view instead of a side view.

Cooling System

Cylinder Water Jackets 49

Buda Cylinders are designed with ample water jacket space so baffled that the water is discharged directly beneath the valves, insuring correct temperature in all parts of the water jacket.

Water absorbs the heat of the engine and passes on to the radiator, where it is cooled. After passing through the radiator it is returned to the cylinders by centrifugal pump or thermo-syphon action and discharges directly beneath the valves. Hence there is a continuous flow of water through the cylinders when the engine is running.

The fan at the rear of the radiator draws the air past the radiator tubes and assists in cooling the water.

Water Jackets Cleaning 50

The water jacket is provided with a large cover easily removed for inspection. In order to clean the water jacket (which should be done thoroughly at least once a year), remove water jacket cover and water inlet pipe attached to cylinder and flush out with hose, using water under pressure if possible. Also flush out the radiator. This is especially necessary in the spring after alcohol has been used.

When draining the water system be sure to also drain the water from the pump.

In cold weather it is especially necessary to drain the water from your car if you are going to let it stand for any length of time. For running it is well to use some such solution as the following:

15% glycerine, 15% wood alcohol, 70% water.

When temperature does not fall below zero, this will prevent freezing, but in lower temperatures more glycerine than alcohol is necessary in proportion to the water.

It is sometimes advisable to disconnect the fan in very cold weather.

Radiator Caution 51

Never fill a radiator with cold water while the engine is running nor when the engine is hot if the amount of water in the radiator is low. A sudden change of temperature in the cooling system is liable to cause cylinder castings to crack.

Kind of Water to Use 52

Always use clean water as free from lime and impurities as possible. Clean rain water is best, as it will keep water jacket free from lime. Water spaces coated with lime or other impurities reduce the conductivity of the water, causing the motor to overheat, thereby increasing oil consumption and reducing the life of the engine.

Fan Belt Adjustment 53

Proper tension on the fan belt is necessary, but fan belt should not be too tight, as it would cause the fan bearing to heat or wear rapidly. Tighten the belt just enough to drive fan without slipping. Fan bearings should be lubricated either by giving the grease cup one turn daily or with a good grade of oil. If the vehicle is in constant use grease cups will need frequent refilling.

Overheating Causes 54

Overheating can be caused by the following: Lack of water, frozen or clogged water passages, loose or missing fan belt, lack of or poor quality of oil, continued driving on low gear, too rich or too lean a mixture, motor missing, the sparks too much retarded, dragging brakes or a slipping clutch.

Adjustments and Replacements

Disassembling and Reassembling 55

In disassembling the motor it will be observed that parts which require reassembling in exactly the same relative position are marked, beginning at the front of the engine (the cylinder next to the timing gear end) with No. 1. See that the parts are put back in their respective places.

In fitting the connecting rods to the crank shaft, it will also be observed that the upper half and cap of the bearing have been numbered for the same reason.

The small oil dipper on the cap half of the bearing in Models RU, OU, QU and TU must be in the correct position to carry oil to the bearing as it revolves.

Pistons and connecting rods may be taken out through the bottom without removing the cylinder block, as Buda design allows pistons to pass the crank shaft.

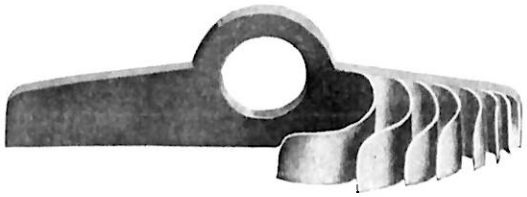


ILLUSTRATION No. 22
This illustrates how the leaves in the laminated shim should be separated for the purpose of making adjustments.

Cautions
56

In reassembling, do not push the piston to the top of the cylinder as this would permit the top ring to expand in the counterbore, with the result that it is quite difficult to remove the piston.

The oil pan or lower half of the crank case contains nothing but the oil reservoir and can be removed without disturbing the motor supports or the main shaft bearings.

Adjustment of Bearings
57

The shims used in connection with the main shaft and connecting rod bearings are of the laminated type (a series of thin sheets soldered together.) When it is necessary to readjust any of these bearings one of the thin sheets should be peeled off the shims on each side of the bearing. Remove these shims one at a time from each side until the proper tension is obtained. Proper fitting of bearings requires that the nuts be pulled tight and that the bearing is tight on the shims, at the same time having the proper tension on the crank shaft.

Adjustment of bearings requires considerable skill and should be done by experienced workmen. Be sure you locate the trouble before attempting any change.

If a bearing is adjusted too tightly it will heat and cause trouble, regardless of the lubrication that may be given it.

Engine Noises
58

Different sounds are caused by loose bearings in the motor. A loose main bearing will pound with a dull thud when pulling under a heavy load; a connecting rod pound is a lighter and sharper thump than a main bearing and can be produced when running down hill with the clutch engaged; a wrist pin knock is a sharp, light tap and is noticeable when the motor is running idle, more pronounced with the spark retarded on low throttle.

The upper end of the connecting rod is fitted with a large phosphor bronze bushing without adjustment. If piston pins become worn and loose in these bushings, new rod bushings will be necessary.

ILLUSTRATION No. 23
Part of the progressive assembly which makes it possible to produce as high grade engines as the Buda in sufficient volume in economical quantities.

Crank Shaft End Play 59

Crank shaft endplay is taken up on the center main shaft bearing and all endplay fitted from that point. It is our practice to allow .004" to .006" endplay in the crank shaft. About 1/32" clearance is allowed on the front and rear bearing to take care of expansion in the crank shaft.

Piston Pins 60

The pins are a light drive fit in the pistons. One end of the piston pin is anchored in the piston, the other end left free to allow for expansion.

Cam Shaft 61

The cams are forged integral with the cam shaft. This shaft is designed so that it can be removed through the front end of the motor, that is, each cam shaft bearing is smaller than the preceding one and all bearings are larger than the cams. The front end of the shaft is provided with a steel ball to take the end thrust.

Cam Shaft Thrust Adjustment 62

A thrust screw in the gear case cover provided with washers of varying thicknesses permits the proper adjustment to be obtained. In making this adjustment the adjusting screw should be run against the steel ball without any washers under the head. The number of washers required can then be determined by fitting between the head of the screw and the gear cover.

Remove the screw and fit the washers in place, adding one more thin washer than necessary to make a tight fit as there should be a slight clearance between the screw and steel ball. By tapping lightly on the screw head as it is being screwed in place it can be determined by sound when the screw makes heavy contact with the ball. Excessive thrust on this ball will result in burning out the front cam bearing.

Magneto Gear Shaft Adjustment 63

This same method as used in adjusting the cam shaft can be employed in making adjustments to the magneto gear shaft.

Tappet Clearance Between End of Valve and Adjusting Screw Head

Adjustment When Engine is Cold. Atmospheric Temperature About 70° F.

Valve Tappet Clearance 64

DIAM. OF PISTON	INTAKE VALVE	EXHAUST VALVE
3″	.004″ or plus	.008″ or plus
3⅛″	.004″ or plus	.008″ or plus
3½″	.004″ or plus	.008″ or plus
3¾″	.005″ or plus	.010″ or plus
4″	.005″ or plus	.010″ or plus
4⅛″	.005″ or plus	.010″ or plus
4¼″	.006″ or plus	.010″ or plus
4½″	.006″ or plus	.012″ or plus

The above valve tappet adjustment should be rechecked after the engine has been thoroughly warmed up, and when the water outlet temperature in engine is between 140° to 180° F.

The valves should then have a tappet clearance adjustment of .003″ on the *intake* valve and .004″ on the *exhaust* valve. In some instances it may be found that the intake valve will not expand in length in proportion to the exhaust valve when the clearance on the intake valve may be found a little greater, which will do no harm. The intake valve clearance should never be less than .003″, and the exhaust valve clearance should never be less than .004″, after the engine is thoroughly warmed up.

The clearances indicated may make the engine noisy when cold, but the valves will quiet down when the engine has warmed up.

Be certain there is sufficient clearance between end of valve stems and valve tappets, *regardless* of engine temperature. This will insure valve seating and avoid burning out the valve seats. For light work (such as city driving) the valves could be set closer for quietness. The harder the work the warmer an engine will get, valve stems expanding in proportion, therefore they would require more clearance.

It is advisable to give new engines extra valve tappet clearance, permitting the valve to become thoroughly bedded and the seat glazed. After which closer adjustments for quietness can be made.

Grinding Valves
65

It is advisable to regrind the valves whenever they become pitted. To remove valves take out spark plugs, priming cups and all valve chamber plugs (with the special wrench which is furnished) and take off valve enclosure cover. Hold down on valve head, lift springs, removing slotted washer at the end of valve stem. Take out valves, springs and spring retainer cups. Then turn down push rod adjusting screw allowing clearance between the valve stem push rod. Close all valve ports with a clean cloth. DON'T USE WASTE.

Place a little of the grinding compound on the valve and valve seat. Replace regular valve spring under head which will just hold valve off its seat. Insert a valve grinding tool or screw driver and turn valves with a semi-circular movement, exerting very little pressure. Occasionally remove the valve from the seat, turn half way around and continue grinding until a light silvery line appears all around the beveled edge of the valve and on the valve seat.

After a proper seat has been made valve stems and guides should be thoroughly cleaned with gasoline and a cloth, making sure that no grains of abrasive remain. Remove cloth from engine ports. Oil the valve stems and guides and replace. It will then be necessary to readjust push rods, as per Paragraph No. 64, regarding "Valve Tappet Clearance."

Do not grind valves unless necessary. An occasional application of kerosene on the valves and stems is beneficial and often saves grinding.

Intake valves seldom need grinding. Exhaust valves being subjected to more heat, should have attention about every 2,500 miles.

General Operating Suggestions

Hill Climbing
66

When approaching very steep hills, it is advisable to speed up the car and as momentum decreases on the grade retard your spark. When the car slows down it is necessary to change to second and third speeds. Do not hesitate to use first and second speeds, as there is nothing to be gained by overtaxing your engine; it simply means that you will cut down the life of the engine and your car much more rapidly.

Going Down Hill
67

In driving down a hill it is possible by shifting to lower gears and leaving the clutch engaged to turn off your ignition, and allow the compression of the engine to act as a brake. By opening the throttle with ignition cut off there is a tendency to cool the engine. Do not open up the throttle sufficient to allow the engine to draw in an excessive fuel which would tend to cut the lubricating qualities of your oil.

Stopping the Engine 68

Do not put your engine to an unusual amount of strain by reversing your car before it comes to a full stop, nor by changing to higher or lower speeds without following the directions of the manufacturer of your car with regard to handling the clutch and throttle.

Although it is advisable to enrich the mixture in your engine just before stopping your motor, do not speed it up, as is the custom with many operators. This does not make starting any easier and it draws gasoline into the motor, which percolates through to the oil, thereby deteriorating its lubricating qualities.

General Overhauling 69

After an engine is run several thousand miles, it is usually advisable to give it a general overhauling. Just when such an inspection is necessary must depend upon the driver, and the care which he is giving the car. If lubrication instructions have been followed carefully, this matter of general overhauling will be delayed considerably, but if any of the instructions have been neglected, a general overhauling may be necessary very much sooner.

Cold Weather Precautions 70

An engine's efficiency is best when reasonably warm. For cold weather operation many manufacturers provide a choker to control the flow of cold air to the carburetor. This allows the engine to draw practically clear gasoline from the carburetor and eliminates the necessity for priming through spark plug hole. In cold weather the engine should be warmed up gradually and not raced. If engine is to be left for any length of time without running it will be advisable to drain the water out to eliminate the possibility of broken parts through freezing.

Storage of Car 71

When a car is to be stored, the spark plugs should be removed and engine oil inserted in the cylinders. Turning the engine over several times will thoroughly lubricate the pistons, cylinder walls and bearings.

Vehicles in constant use should be housed in a warm garage. This prevents oil from congealing, and facilitates starting.

Spare Parts 72

The illustrations contained in this book are designed to show in a general way what the text is about. This is not a Repair Part book, and if you need spare parts, either write to the manufacturer of your car for a repair list, or if that firm is not now in business the parts can be secured from The Buda Company.

ILLUSTRATION No. 24